

Dermato-Venereological Research at University of Gothenburg

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Research at Sahlgrenska University Hospital

The Department of Dermatology and Venereology at Sahlgrenska University Hospital recently celebrated its 50th anniversary. Since its inauguration the department has worked hard to create the strong research tradition that it is known for today. Over the years our research has led to greater knowledge regarding the aetiology of many skin disorders, as well as improvements in their diagnosis and treatment. We carry out interdisciplinary clinical research within several areas of our specialty (e.g. skin cancer, microorganisms, contact dermatitis, venereal diseases, leg ulcers, vitamin D, sunscreens and psoriasis).

Techniques for discovering skin cancer

The dramatic increase in the number of patients affected by skin cancer in Sweden during the past decades has resulted in our group carrying out large research projects within this field. We work actively with skin cancer prevention and early diagnosis through prevention campaigns and technological solutions. New diagnostic methods, such as multi-photon laser scanning microscopy, are being tested for non-invasive diagnosis of skin cancer. Another imaging technique is fluorescence diagnostics, which we hope can improve the demarcation of non-melanoma skin cancers. We have also carried out numerous studies on photodynamic therapy and how to avoid pain during treatment. In Fig. 1 you see photodynamic therapy in action. Furthermore, we have studied the long-term effectiveness of Mohs' micrographic surgery in the treatment of aggressive basal cell carcinomas. We also collaborate with various pharmaceutical companies to test new topical treatments for non-melanoma skin cancer. Recently, we have also initiated several studies in collaboration with the Department of Occupational and Environmental Medicine at the University of Gothenburg and Chalmers University of Technology to study the reasons for the rapid increase in the incidence of melanoma and squamous cell carcinoma in western Sweden and how we can improve patient flow within the national healthcare system.

Vitamin D and sunscreens

Vitamin D and sunscreens are two very exciting and heavily debated research fields that our department

are working on. Vitamin D, which is synthesized in the skin after exposure to ultraviolet radiation, is important for skeletal health, but has also been shown to be protective when it comes to several types of cancer. On the other hand, too much ultraviolet radiation is harmful and can lead to skin cancer. Thus, sunscreens are being produced in order to lessen this risk. The aim of our researchers is therefore to find an answer to the questions of how much sun is beneficial for us and when does sun exposure do more harm than good. Studies have been initiated to determine the amount of vitamin D produced by people with different skin types through exposure to ultraviolet light in comparison with the amount they can absorb through the digestive system when treated with vitamin D supplements. Regarding sunscreens, our researchers have performed analyses of the photostability of various commercial products, as well as their percutaneous absorption.

Microorganisms

Bacteria, viruses and fungi lie behind a great variety of infections that can affect the skin, hair and nails. Several researchers at Sahlgrenska University Hospital are studying the importance and the effects of different microorganisms on skin disorders, such as atopic dermatitis, psoriasis and acne. Multi-resistant bacteria are increasingly a problem within healthcare today. Therefore, we are also studying the frequency of resistance to antibiotics among our patients and developing new methods of treating bacterial infections that will work when antibiotics are no longer effective.

Contact dermatitis

Thanks to collaborations with chemists and biologists, we are also gaining new knowledge within the field of contact dermatitis. Together, we have been able to explain why and how certain fragrances used in cosmetics and personal hygiene products can cause contact allergies. Several studies are underway with the objective of improving patch tests so that they can confirm that the chemicals we test do in fact cause contact allergies. Other researchers at our department are studying the consequences of using aluminium salts as an adjuvant in vaccines for children.



Prof Olle Larkö, Dean of the Sahlgrenska Academy, University of Gothenburg.



John Paoli, PhD, Department of Dermatology.



Jan Faergemann, Professor of Dermatology.



Ann-Marie Wennberg Professor of Dermatology.



Fig. 1. Photodynamic therapy at Sahlgrenska University Hospital performed by nurse Barbro Petersson.

Research at the Dermatochemistry and Skin Allergy Group ANN-THERESE KARLBERG

Dermatochemistry and Skin Allergy Group, Department of Chemistry, University of Gothenburg, Sweden

Increasing exposure to chemicals in the personal environment causes a corresponding increase in cases of allergic contact dermatitis. It is currently estimated that 20–25% of the population of Western Europe is sensitized to one or more chemicals.

During the last 9 years, research in Dermatochemistry and Skin Allergy has become an important part of the research carried out in the Department of Chemistry at the University of Gothenburg. Taking as its starting point an understanding of the basic mechanisms of allergenic compounds, research into contact allergy approaches from a different angle from the usual clinical starting point. This allows for an in-depth understanding of what makes a molecule an allergen and increases the possibilities for primary preventive work. Compounds that are not sensitizers themselves, but that are activated either in the skin by bioactivation, or outside the body by autoxidation, are a focus of the research. The skills within the group are broad, including chemists, pharmacists, dermatologists and immunologists, which allows for investigations using organic synthesis and analytical chemistry in combination with *in vitro* and *in vivo* studies on sensitizing capacity.

Activation of non-allergenic compounds into potent contact allergens by oxidation in the air (autoxidation) is of major research interest. Unsaturated hydrocarbons, which are not allergenic themselves, can be activated outside the body by autoxidation to form a mixture of oxidation products, some of which are potent skin sensitizers. Monoterpenes, which are used as fragrance components, belong to this group and have been shown to oxidize into important fragrance allergens when exposed to air. Diagnostic tools for fragrance allergies have been developed and used in clinical studies performed by Dr Johanna Bråred-Christensson, working partly in the group and partly at the dermatology clinic at Sahlgrenska University Hospital.

Venereal diseases

In addition, venereological diseases are being studied at our department in order to improve the management of patients with infections such as chlamydia and herpes. We also carry out studies on leg ulcer treatment with larval therapy and punch grafting. Lastly, we actively participate in national and international clinical trials, especially in the field of psoriasis, in order to improve the therapies we will have to offer our patients in the future.

Concluding remarks

In summary, our goal has been, and will continue to be, to provide high-quality research within the most important fields of our specialty. We are certain that our previous research results played a significant role when we were given the opportunity to host the 19th Congress of the European Academy of Dermatology and Venereology in 2010.



Professor Ann-Therese Karlberg, Head of the Department of Dermatochemistry and Skin Allergy.

The impact of “free radicals” on health has been debated. Investigations of a radical mechanism involved in the formation of immunogenic hapten-protein complexes by hydroperoxides, the most important haptens formed by autoxidation, have been performed. For the first time we have demonstrated that radicals form specific immunogens, causing contact allergy.

A major area of work within research into contact allergy is the study of the structure-activity relationship (SAR) using series of compounds modelled from one original allergenic hapten. The chemical reactivity of the model compounds with peptides and proteins, as well as their sensitizing capacities, are investigated in order to elucidate what structural alerts make the molecules allergenic.

Understanding of the metabolic activation of various groups of compounds is also of major interest in the group, and work is performed in cooperation with researchers in Sweden and abroad. As enzymatic activity in the skin can turn non-sensitizing compounds (prohaptens) into sensitizers, investigation of bioactivation has become important in the prediction of the sensitizing potential of compounds.

Studies regarding the formation of photoallergenic and/or allergenic compounds from sunscreens, and the development of alternative sunscreens, is a major research area within the group of Dermatochemistry and Skin Allergy. This work is headed by Dr Anna Börje in cooperation with Professor Jerker Mårtensson at Chalmers University of Technology.

A promising area of research with regard to contact allergy is the investigation of the localization and distribution of fluorescent

allergenic compounds in human skin, based on visualization using bioimaging techniques in cooperation with Dr Marica Ericson at the Department of Physics, University of Gothenburg. The impact of nanotechnology on allergic contact dermatitis is also investigated with this technique.

Centre for Skin Research

The Centre for Skin Research (SkinResGU; www.skin.org.gu.se) is an interdisciplinary research centre at the University of Gothenburg. The joint competence within the centre is unique because of the close collaboration between various groups at the Faculties of Science and Medicine. The centre also collaborates closely with groups at Chalmers University of Technology (Chalmers), Gothenburg. This brings together competences within the fields of biophysics, dermatochemistry, dermatology, immunology, laser spectroscopy, medicinal chemistry, nanotechnology, odontology, organic chemistry, pharmaceutical technology, rheumatology, and physical and surface chemistry. The overall goal of the centre is to develop new improved tools to effectively prevent, diagnose, and treat skin cancer and skin allergy, as well as to extend the use of the transdermal route for drug delivery. This will be achieved by creating fundamental understanding and enabling control of the molecular processes involved in the interactions between the human skin and xenobiotics, nanoparticles, and radiation.



Some of the researchers within the Centre for Skin Research at the University of Gothenburg (SkinResGU) during a seminar last year.

The significance of the research centre is huge, as skin cancer and skin allergy are two of the most common health concerns worldwide, with increasing incidence in the population.

Sahlgrenska University Hospital (top photo)

White arrow indicates the location of Department of Dermatology and Venereology.



Entrance of the Department of Chemistry, University of Gothenburg



Facts

The University of Gothenburg was founded in 1954 as a merger between Gothenburg's College (founded in 1891) and Gothenburg's Medical College (1949). Today, the university employs over 5,300 people and is attended by approximately 37,000 students.

The Department of Dermatology and Venereology within the Faculty of Medicine appointed their first Professor in 1953. The department is part of the Institute for Clinical Sciences at Sahlgrenska Academy.

Department of Dermatology and Venereology at Sahlgrenska University Hospital:

- The group of researchers comprises:
- 3 Professors
- 1 Assistant Professor
- 9 PhD researchers
- 8 doctoral students

The group publishes approximately 20 original articles per year.

Six theses have been published during the last 3 years.

Dermatochemistry and Skin Allergy, Department of Chemistry:

- The group of researchers comprises:
- 1 Professor
- 6 PhD researchers
- 5 doctoral students

The group publishes approximately 10 original articles per year.

Four theses were published 2009–10 and additional 3 will be defended in 2011.